

124-57-2-2440

Translation from: Referativnyy zhurnal, Mekhanika, 1957, Nr 2, p 132 (USSR)

AUTHOR: Nemm. V. A.

TITLE: Experimental Investigation of the Strength of Hydraulic-turbine Parts (Eksperimental'noye issledovaniye prochnosti detaley gidroturbin)

PERIODICAL: V sb.: Gidroturbostroyeniye. Nr 1. Moscow-Leningrad, Mashgiz, 1955, pp 194-209

ABSTRACT: Description of an experimental investigation of the stresses in component parts of the PL-587 turbine for the hydroelectric power stations at Kuybyshev and Stalingrad: the runner blades (a 1/20-scale model, made of L-30 steel, with a uniformly distributed load of 5 kg/cm<sup>2</sup>), the runner coverplate and the servomotor master cylinder (full-scale, with an internal pressure of 40 atm), and the welded shroud ring (St. 3 steel 1/5-scale model, tested on a special device which simulates the forces exerted by the servomotors). The stress measurements were performed by means of electric strain gages; the patterns of the principal stresses were determined by means of the lacquer "stress-coat" method. N. A. Kartvelishvili

Card 1/1

1. Turbines--Equipment 2. Turbines--Mechanics

SOV/124 58 4 4778

Translation from: Referativnyy zhurnal Mekhanika 1958 Nr 4 p 155 (USSR)

AUTHORS: Rudashevskiy, G. Ye., Nemm, V. A.

TITLE: Investigations of Pressures and Deformations in the Components of Variable-pitch-blade Turbine in Actual Service (Issledovaniya davleniy i deformatsiy v elementakh povorotnolopastnoy turbiny v ekspluatatsionnykh usloviyakh)

PERIODICAL: V sb.: Gidroturbostroyeniye Vol 4. Moscow Leningrad Mashgiz 1957 pp 127-137

ABSTRACT: Results of experimental investigations of the pressures on the blades and the walls of the housing as well as the deformations of the blades of the Tsimlyanskaya hydraulic turbine installation are presented. Analysis of the experimental data reveals the following: 1) During the pre-start up period the pressure on the blades and on the housing increases rapidly with an increase in the opening of the distributor  $\alpha_0$  and attains a maximum value for  $\alpha_0 = 30\%$ . As soon as the turbine starts moving the pressure falls and remains constant with the establishment of normal rpm. With an increase in power the pressure in the housing

Card 1/2 increases gradually but then between  $\alpha_0 = 65\%$  and  $\alpha_0 = 70\%$

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Investigations of Pressures and Deformations (cont.)

it falls off sharply and thereafter remains approximately constant. 2) Max. mum stress ( $\sigma = 700 \text{ kg/cm}^2$ ) occurs in the root section of the blade in the pre start-up period. With an increase in rpm the compression strains on the trailing edge of the blade are changed into tensile strains and under normal rpm the tensile stresses attain  $370 \text{ kg/cm}^2$ . 3) During the starting cycle blade vibrations attain resonance at 20-25 cps frequency which approximates the value of the first non nodal form of vibration obtained by taking into consideration the entrained mass of water. Under these conditions the available amplitude component of the deformation is 60% of the static value.

A. D. Kovalenko

1. Turbines--Stresses
2. Turbines--Pressure
3. Turbines--Vibrations
4. Mathematics

Card 2/2

SOV 174 58 1 1240

Translation from: Referativny zhurnal. Mekhanika, 1958, No. 1, p. 155 (USSR)

AUTHOR: ~~Nemnn, V. A.~~

TITLE: On Some Cases of the Fracture of Hydraulic Turbine Blades (O nekotorykh sluchayakh porivov i klapaste gidroturbin)

PERIODICAL: V sb. Gidroturbostroeniye. No. 4. Moscow Leningrad Mashgiz, 1957, pp. 178-182

ABSTRACT: Presentation of materials pertaining to the failure of blades of large turbines of several domestic and foreign hydroelectric power plants. The circumstances of the failures, the appearance of the fractures, and the presumable causes of the failure are discussed.

Reviewer's name not given

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22/60/000/005 017 017  
A.B. A130

15 8360

AUTHORS: Nemr, V. A. [illegible] - Engineers

TITLE: Investigations and practical application of polyamide slide bearings in Czechoslovakia

PERIODICAL: Vestnik mashinostroyeniya, no. 6, 1960, 72-74

TEXT. Information on bearings from a butadienam-type polyamide called "silon" in Czechoslovakia is given. The transport research institute Výzkumný ústav dopravní in Prague conducted laboratory and service tests of silon bearings during 1954-1958. Some properties of this material are given: melting point  $220^{\circ}\text{C}$ , specific weight  $1.13 \text{ g/cm}^3$ , tensile strength  $500-700 \text{ kg/cm}^2$ , elongation  $270-300\%$ , heat resistance - Markers are 40-45,  $\text{Nik 10-180}$ , linear expansion factor per  $1^{\circ}\text{C}$   $10-11 \cdot 10^{-5}$ , heat conductivity  $0.23 \text{ kcal/m} \cdot \text{m}^2$ , moisture absorption to saturation  $9.5\%$ , content of low-molecular compounds  $5-12\%$ . Two bearing types are recommended after tests: (1) with silon, or metal with thin silon coating, on metal; (2) with silon on metal. (3) with silon on metal. bearing, and a sliding bearing on metal. The first type is used on bushings are pulled on an arbor, heated to  $100^{\circ}\text{C}$ , the bush is expanded, then pulled.

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25678 3/22/80/100/005/017/017  
A161/A130

Investigations and practical application.

pulled on the shaft transition using a short tapered end piece. It is recommended to prevent air pockets on the transition by ventilation ducts in devices used for pulling bushings on trunnions, and negative allowance on the bushing (2-3 mm on a side) to make it fit tight. Sand blasting or grooves on the trunnion improve hold. Coating with silon is recommended by dusting with a YTH-4Y (CPN-40) pistol of VNIITavtogen design, produced by Barnaul'skiy apparaturno-mekhanicheskii zavod (Barnaul Mechanical Apparatus Plant), onto shafts rotating with 40 rpm and heated to 280°C. The coating depth with an allowance for final machining has to be 2.5-3 mm (final depth of less than 1.8 mm is not recommended). Silon bearings had been tested on automobile engines and its motive parts, and it was stated that split bushings withstood 3 months, but solid unsplit worked for 3-9 months. Type 2 bearings (with dusted-on coating on trunnion) were worn only 0.2 mm (summary on bearing and trunnion) after 95-165,000 km on locomotives. Some faults were stated (weak adhesion to metal, expansion from humidity, heterogeneous layer structure, casting and assembly defects, etc.), but in general silon proved good. Best suitable steel composition for friction with silon is a) 0.12% C; 0.45% Mn; 0.29% Si; 0.019% P; 0.009% S; b) 0.18% C; 0.79% Mn; 0.25% Si; 0.031% P; 0.015% S. Mixed amorphous-crystalline structure was revealed in 2.5-3 mm layers by x-rays. It is, therefore, recommended to use heat treatment holding for

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Investigations and practical application ...

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5-10 min in oil at 160-170°C, and improving resilience after this treatment by 2 boiling in water. Apart from bearings silong is used for ball and roller bearing separators, small gears (pressed with final dimensions). The Plant im. V. I. Lenina in Plsen uses it for bearings, gages, seals, pump vanes, etc. There are 2 figures, 2 tables and 6 Soviet-bloc references.

X

Card 3/3

87886  
S/114/60/000/008/010/010  
E073/E535

2109  
2109  
15.8340 2808

AUTHORS: Nemm, V. A. and Filippovich, S. A., Engineers  
TITLE: Application of Polyamide Plastics in Czechoslovakia  
PERIODICAL: Energomashinostroyeniye, 1960, No. 8. pp. 47-48  
TEXT: The use of polyamide bearings is impeded by the absence of research and practical data on this material. From that point of view Czech experience on using bearings made of Silon is of interest, a material similar to that of "polycaprolactam" manufactured by Soviet industry.  
(Abstractor's Note: "Silon" is a polycapronamide  $(-\text{HN}(\text{CH}_2)_5\text{CO}-)_n$ ,  $\rho = 1.14$ , b.p.  $205-215^\circ\text{C}$ )

Tests on an Amsler machine ( $p = 45 \text{ kg/cm}^2$ ,  $v = 0.39 \text{ m/sec}$ , lubrication with oil of the viscosity  $5.6^\circ \text{E}$  at  $50^\circ\text{C}$ ) have shown that the friction coefficient and the wear of rubbing pairs depend to a great extent on the quality of the machined surface and on the hardness of the roller. The test data are summarized in the following table (Ref. 1):

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Application of Polyamide Plastics in Czechoslovakia

Class 7 surface

Class 10 surface

	wear, mg/h		friction coefficient	wear, mg/h		friction coefficient
	roller	specimen		roller	specimen	
Unhardened	16.6	16.2	0.07	12.8	9.2	0.03
Hardened to RC 45-48	5.8	12.0	0.05	2.4	6.4	0.03

According to work published by the Prague Scientific Research Institute for Transportation (Refs. 2 and 3), between 1954 and 1958 about 1600 Silon bearings were investigated in various locations in locomotives. It was found that ordinary thick-walled (6 - 5 to 10 mm) bushings and liners had an operating period of 3 to 7 months. The so-called "reverse pair": a) jacket (6 = 3 to 4 mm) made of a Silon tube pressed onto a shaft with diametral stretching by 2 to 6 mm and steel liners had a service life twice as long as

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# Application of Polyamide Plastics in Czechoslovakia

ordinary bronze bearings; b) linings ( $\delta = 1.8$  to  $3$  mm) of journals obtained by hot spraying of Silon powder, followed by an appropriate heat treatment in oil (Ref. 4); rubbing against a steel liner showed a total wear of the rubbing pair below  $0.2$  mm after a run of the locomotive of 90 to 165 thousand kilometres. The high wear of thick bushings (liners) is attributed to the low heat conductivity of the Silon and resulting easy fusibility of the surface; adhesion to the neck of the shaft, chipping off of the Silon and washing away of particles with the lubricant. Using facings with thicknesses below  $1.8$  mm also proved unsuitable; frequent tears and damage of the facings, due to adhesion to the basic metal of the journal, could be detected. Testing of the Silon bearings under natural conditions was mostly effected at circumferential speeds of  $v < 1.2$  m/sec and specific pressures of  $p = 100$  to  $150$  kg/cm<sup>2</sup> with normal lubricant supply at the beginning, after running in; the oil supply was cut down by 50%. The shaft-liner clearance was  $0.1$  to  $0.15$  mm; the metallic neck of the shaft and the liner were ground and polished. Silon liners also proved successful in Skoda motor cars (Ref. 5). The liners were in operation over long periods with Card 3/4

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Application of Polyamide Plastics in Czechoslovakia

specific pressures of 80 kg/cm<sup>2</sup> at  $v = 1$  m/sec, whereby the temperature of the circulating oil  $T \leq 130^{\circ}\text{C}$  and after a 22 000 km run the wear was less than 0.02 mm. In addition to the above mentioned applications, Silon has been used in Czechoslovakia in the manufacture of separators, ball and roller bearings (Refs. 6 and 7). At the V. I. Lenin Works, Pilsen, Silon is extensively used as a material for seals, gears, bearings, gauges, blades of the runner wheels of pumps, blades of fans, and model turbines, etc. The cost of most Silon components is 50 to 60% below that of similar metallic ones. The Czech experience could be usefully applied in new designs of turbo-machinery, pumps, compressors, controller, reductor gear and other parts. As regards the physico-mechanical and the anti-friction properties (particularly at speeds of 0.5 to 1.2 m/sec and pressures of  $p \leq 150$  kg/cm<sup>2</sup>) they are fully suitable for replacing metals and in many cases they have a better wear resistance. There are 1 table and 7 Czech references. (NOTE: This is virtually a complete translation).

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88550

S/191/60/000/011/007/016  
B013/B054

158000 (2209)

AUTHOR: Nemm, V. A.

TITLE: Use of Thermoplastic Materials for Journal Bearings

PERIODICAL: Plasticheskiye massy, 1960, No. 11, pp. 23-31

TEXT: The author reports on studies of properties of thermoplastics and their applicability as a raw material for the production of bearings. He deals with studies of antifriction properties of fluoroplast and polyethylene (Table 1, Figs. 3-5), as well as polyamides (Table 2). Since the polyamides were tested on different machines, with different numbers of samples, and without appropriate control, it was difficult to determine the effect of the individual factors (load, speed, lubrication, wall thickness, etc.) on friction coefficient, carrying capacity, and wear. For this reason, the author investigated the effect of technological and constructive factors separately: wall thickness of bearing boxes (Fig. 6); degree of polymerization, structure, and heat treatment (Figs. 7, 8); rubbing speed, specific load, and temperature of the medium (Figs. 9-13); purity of surface treatment (Fig. 14). Finally, he reports on works tests of

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Use of Thermoplastic Materials for  
Journal Bearings

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polyamide bearings performed at the Scientific Research Institute of Transportation in Prague in 1954-58 (Fig. 15). On the basis of available test data, the following conclusions can be drawn: Bearings of unfilled fluoroplast have a dry-friction coefficient of 0.04 - 0.1, and can be used at

$p \leq 0.4-0.5 \text{ kg/cm}^2$ . Even small lubrication reduces the friction coefficient to 0.02. The carrying capacity of fluoroplast is invariably limited by the admissible permanent elongation. Cold deformation, for instance, attains about 1% at a pressure of  $40 \text{ kg/cm}^2$ . The speed is limited by the efficiency of heat abstraction. The admissible working temperature of fluoroplast attains  $260^\circ\text{C}$ . With introduction of fillers (graphite, molybdenum disulfide, copper, glass fiber), heat transfer can be much increased, and deformation under load can be reduced. Resistance to wear increases in this connection. The friction coefficient is reduced by some fillers. With the use of graphite or bronze, for instance,  $p_v$  can be brought to  $2-12 \text{ kg/cm}^2$ . In some cases, at  $P_v \leq 0.5$  and dry friction, or at  $p_v \leq 5-6 \text{ kg/cm}^2$  and water lubrication, it is possible to use cheaper polyethylene bearings. As to carrying capacity, friction coefficient, and

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Use of Thermoplastic Materials for  
Journal Bearings

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resistance to wear, polyamide bearings are equivalent to the best metal alloys, antifriction metals, and bronzes. They can be operated at  $pv \leq 400 - 500 \text{ kg/cm}^2 \cdot \text{m/sec}$  with lubrication by oil or solid lubricants. With water lubrication, friction coefficient and wear are slightly higher, the admissible  $pv$  is reduced by one-half. Unlike metals, polyamide bearings are quickly worked in, and can be continuously operated with reduced lubrication (50%). Without any lubrication, they may be operated for short periods (with interruptions), or for longer periods with reduced  $pv$  (down to  $10 \text{ kg/cm}^2 \cdot \text{m/sec}$ ). Here, wear is smaller than in metals, and seizing has not been observed. Polyamide bearings are suitable under impact stress and in cases where solid particles may enter the bearing. High-quality polyamide bearings can be produced with appropriate control of moisture, degree of polymerization, and structure. Heat treatment and reduction of wall thickness are efficient means to reduce deformation and increase the carrying capacity. With smaller wall thickness and introduction of fillers, heat abstraction is improved and admissible speeds and loads are increased.  $pv = 1000$  and more may be attained. Since test conditions in

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Use of Thermoplastic Materials for  
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the laboratory deviate from operational conditions, the data obtained only give a relative judgement of friction coefficient, carrying capacity, and resistance to wear. Effective values of these factors for certain working conditions can only be determined on special bearing test machines with maximum possible imitation of real working conditions. There are 15 figures, 2 tables, and 15 references: 11 Soviet.

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NEMM, V.A., inzh.; FILIPPOVICH, S.A., inzh.

Investigation and use of polyamide sliding bearings in Czechoslovakia. Vest.mash. 40 no.5:72-74 My '60. (MIRA 14:4)  
(Czechoslovakia—Bearings (Machinery))



NEM, V.A.; FILIPPOVICH, S.A.

Machine for testing bushings operating under heavy loads. Zav.lab. 27  
no.3:341-344 '61. (MIRA 14:3)

1. Leningradskiy metallicheskiy zavod im. Stalina.  
(Testing machines)

NEMM, V.A., inzh.; FILIPPOVICH, S.A., inzh.

Using nonmetallic bearings in friction joints of motor vehicles.

Vest.mash. 41 no.10:42-44 0 '61. (MIRA 14:10)

(Nonmetallic bearings) (Motor vehicles)

FILIPPOVICH, S.A., inzh.; NEMM, V.A., inzh.

Some data on research and use of diagonal hydraulic turbines.  
Energomashinostroenie 9 no.8:45-48 Ag '63. (MIRA 16:8)  
(Hydraulic turbines)

HEMM, Yu. (Tallinn)

Volunteer fire brigades in Estonia. Posh. delo 4 no. 7:21 J1 '58.

(MIRA 11:8)

(Estonia--Fire departments)

NEMNONOV, A.G.

MARKOV, N.F.; NEMNONOV, A.G.; VANYASHOV, P.G.

HMV machine for cleaning the edges of fabrics. Tekst.prom. 14  
no.10:45-47 3 '54. (MIRA 7:10)  
(Textile machinery)

VANYASHEV, P.G.; NEMMONOV, A.G.

Changing beam warping machines into machines of "soft warping."  
Obm.tekh.opyt. [MLP] no.15:3-17 '56. (MIRA 11:11)  
(Warping machines)

NEMNONOV, N.

Morning on Swan Lake. Sov. foto 23 no.6:45 Je '63.

(No subject headings)

(MIRA 16:7)

NEMODA, Dorda, inz., asistent (Beograd, Zmaja od Hocaja 13/2)

Production of cobalt-60 radioactive sources. Pt. 1. Tehnika Jug:  
Suppl.: Radioizotopi zrac 2 no.2:229-233 Fe '63.

1. Institut za nuklearne nauke "Boris Kidric", Beograd-Vinca.



NEMODA, Dorde, inz.asistent (Beograd, Zmaja od Noca 13/2-53)

Some methods in preparing the standards of radioactive alpha and beta sources of uranium. Tehnika Jug:Suppl.:Radioizotopi zrac 2 no.3:429-433 Mr '63.

1. Institut za nuklearne nauke "Boris Kidric", Beograd-Vinca.

DRIMER, D.; TARANU, P.; HAFNER, A.; VESCAN, L.; NEMODA, L.

Studies on the diffusion of antimony in monocrystalline silicon.  
Studii fiz tehn Iasi 13 no.1:39-50 '62.





[illegible]

NEMNONOV, S. A.

ARKHAROV, V. I., KOLESNIKOV, G. N. AND NEMNONOV, S. A.

C.A. Vol. 38, Nov. 20 and Indexes, 1944

"\_\_\_\_\_ of gas-chromized Carbon Steel Against Corrosion in Sulfur-Containing \_\_\_\_\_", V. I. Arkharov, G. N. Kolesnikov and S. A. Nemnonov. J. Applied Chem. (U.S.S.R.) 16, No. 11/12, 405-12 (1943); cf. C.A. 38, 26029

Coatings of the \_\_\_\_\_ carbide type obtained on steel contg. 0.3% C by gas-chromizing were tested for corrosion in aq. solns. of  $H_2SO_4$  and in S-contg. atm. at elevated temps., in comparison with samples of high-Cr steel, mild steel, Armco iron, steel V2A and electrolytic Cr. The gas-chromized steel was superior to all other materials under the test conditions.

*NEMNOV, S.A.*

ARKHAROV, V. I.; KOLESNIKOV, G. M.; NEMNOV, S. A.

Gas Chromatization of Iron and Steel Products

"Texco" Files ITEIN, 3rd Series (The Struggle against Corrosion), No. 210/10, 1943

NEMNONOV, S. A.

Physical Nature of Electrolytical Chromium and of its Carbide Phases.  
Ural State University imeni Gorkiy, Sverdkovsk, 1946.

So: U-1837, 14 April 52.



1st and 2nd Grades

ADD, ENDS AND PROPERTIES INDEX

A

4-131. Nature of Hexagonal Chromium and Structure of Electrolytic Chromium Deposits. (In Russian) S. A. Nemnomyov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Feb. 1948, p. 239-248.

Critical study of the literature indicates that hexagonal Cr. should be considered as a metastable phase. During electrodeposition, with a high degree of dispersion of the newly formed crystal, hexagonal Cr has the lowest amount of free energy 26 ref

*Inst. Physics of Metals, Ural Affil, AS USSR*

450 31A METALLURGICAL LITERATURE CLASSIFICATION

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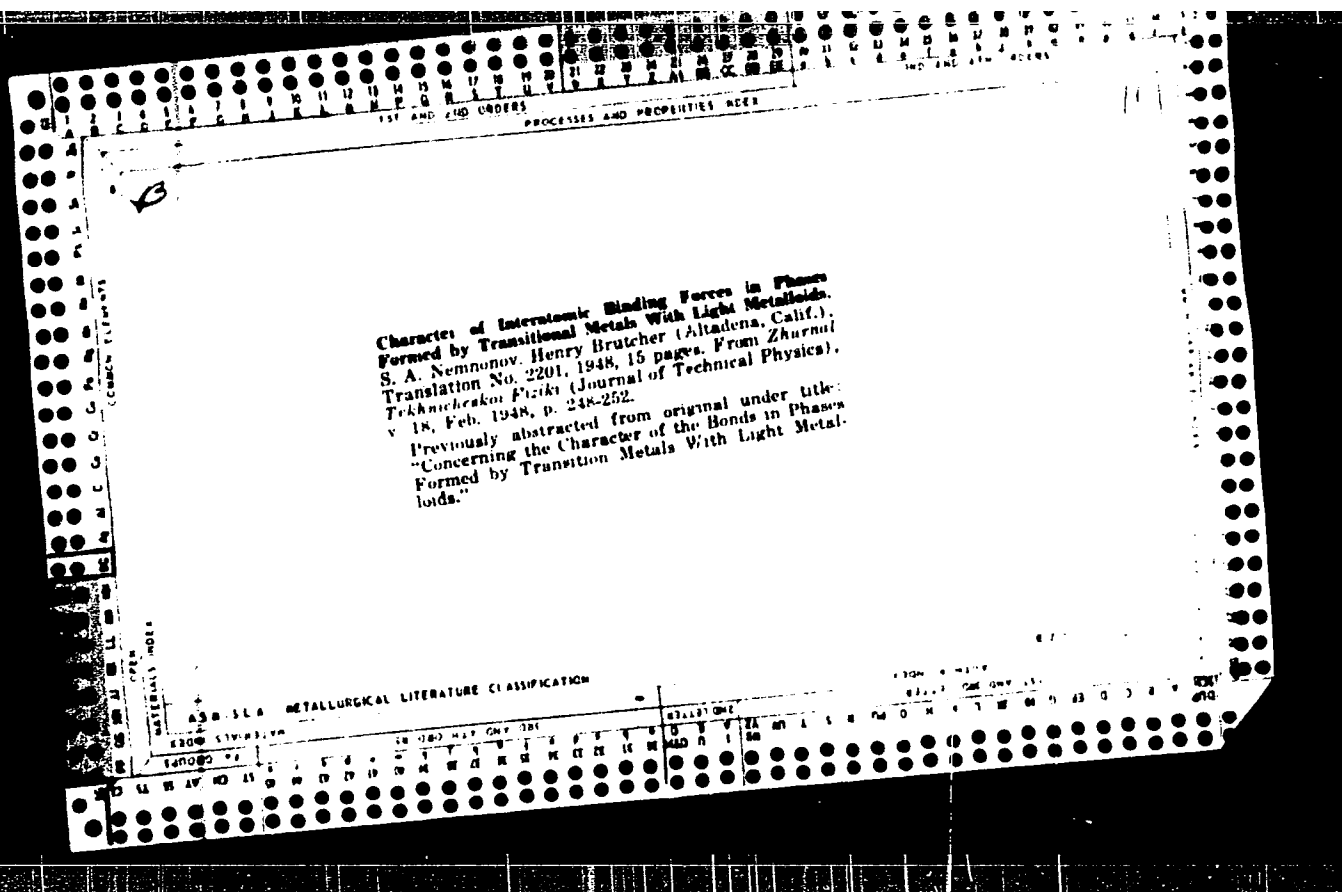
CT

2

Nature of the bonds in phases formed by transitional elements (chromium) with light metalloids. S. A. NEMENOV, *J. Tech. Phys. (U.S.S.R.)* 18, 247-53 (1948). Theories of the nature of bonds formed between transition metals with metalloids, especially the Cr-II, Cr-N, Cr-C, and Cr-O bonds, are surveyed critically. The x-ray results of earlier workers are explained. In doing, the possibility of the formation of penetration phases, the effect of the character of the interst. bonds on the dimensions of the lattice and consequently on the type of structure must be considered as well as the relative at. radii. Interst. bonds in the Cr nitrides penetration phases are not of a metallic character but are homopolar as in the Cr carbides. Finally the carbides and nitrides of other metals have these bonds (at least those of metals with a small "electron defect"). In a series of phases formed by the same transition element with H, C, N, and O there is a gradual transition from 1 type of bond to the other. In a series of phases formed by different transitional metals with the same metalloids (other than O), the character of the bond is detd. by the "electron defect" of the metal atoms.

R. A.

1957



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PHASE I BOOK EXPLOITATION

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207/26-4-20

Academy of Sciences USSR, Ural Branch, Institute of Metal Physics, Ural Branch, Academy of Sciences USSR, No. 20. Printed. 1958. 408 p. Errata slip inserted. 1,000 copies.

Eds.: S.V. Yonovskiy, Corresponding Member, Academy of Sciences USSR, and V.I. Arkharov, Doctor of Technical Sciences.

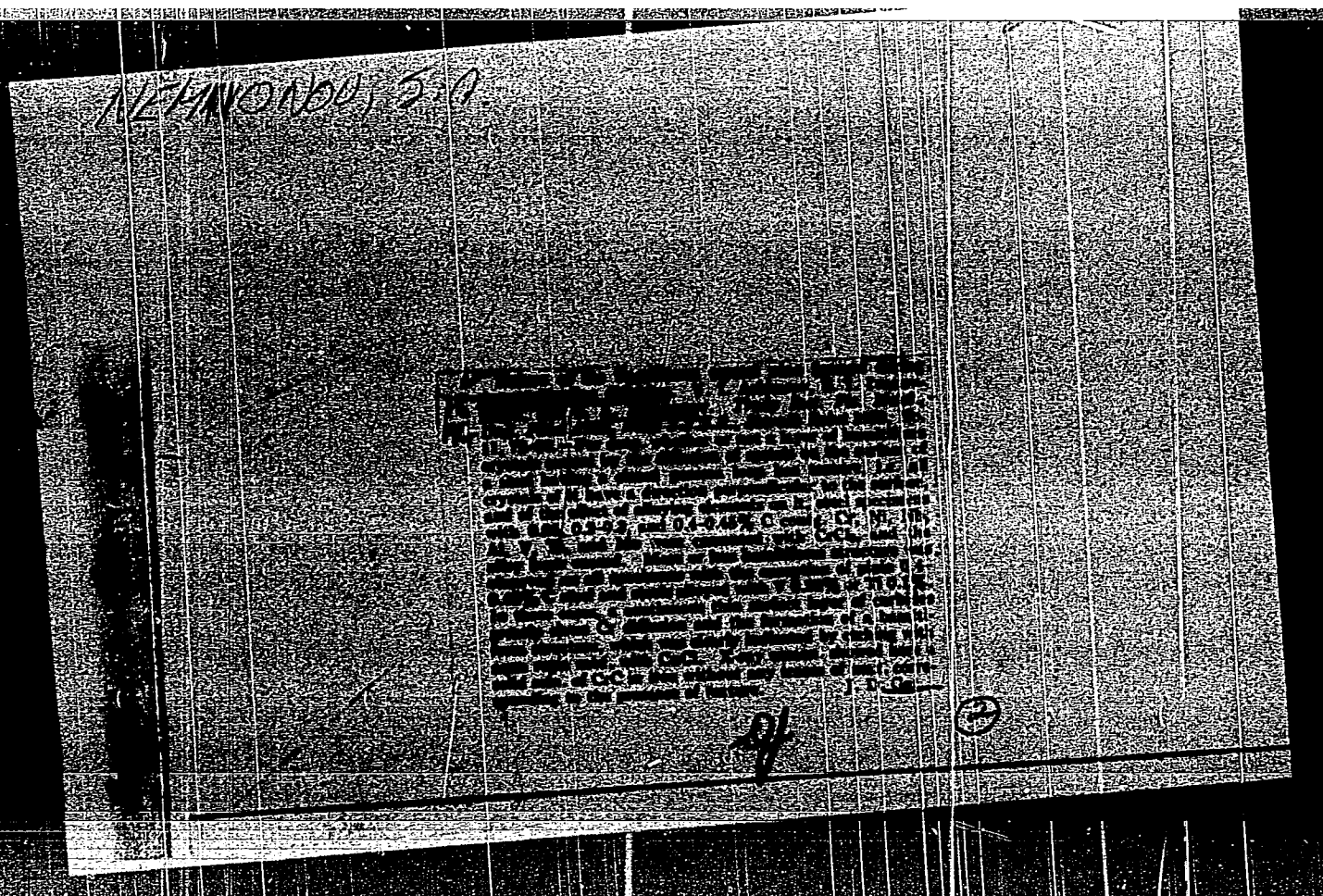
PURPOSE: This book is intended for scientists working in the field of physical metallurgy.

COVERAGE: This is a collection of 26 articles written by members of the Institute of the Physics of Metals, Ural Branch of the Academy of Sciences USSR, on problems investigated at the Institute. Studies at the Institute have concentrated on the basic problems: 1) developing a theory of metals and alloys and finding ways to improve the properties of engineering materials; and 2) developing new physical methods for investigating and controlling the quality of materials and metal articles. In connection with these basic problems the articles in the collection treat the following subjects: problems of the distribution of quantum-mechanical theory in solids; the laws of diffusion and diffusion of admixtures in various metallic alloys (internal absorption theory); strength and plasticity of polycrystalline materials in relation to internal forces, dislocations in the theory of the magnetic structure of ferromagnetic materials; theory of the heat treatment of steel; and the physical theory of magnetic measurements of steel detection and structural analysis. The first article, "Magnetic detection of the work hardening of steel," is a review of the work of departments and laboratories done by the Institute and a list of several persons are cited for their work at the Institute. References accompany each article.

S. Shur, Ya. S. Magnetic Structure of Highly Covalent Ferronitrides 111	
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2

*Aging of cyanide bath and its effect on steel and iron*  
 S. A. Nemboinov, *Trudy Inst. Fiz. Met.*, 1960, No. 11, 18-24.  
 The nature of the thin, unetchable outside layer on cyanide articles which renders them brittle was investigated. In all cyaniding baths the 1st reaction is of the type  $2\text{KCN} + \text{O}_2 \rightarrow 2\text{KCNO}$  which is then followed by a continuous decomposition of cyanates according to  $4\text{KCNO} \rightarrow \text{K}_2\text{CO}_3 + \text{KCN} + \text{CO} + \text{CO}_2$ , leading to the accumulation of carbonates, but not to an etching of the bath. In a fresh bath, the reaction is  $\text{KCN} + \text{O}_2 \rightarrow \text{KOCN}$ , the decomposition of which is  $\text{KOCN} + \text{KCN} \rightarrow \text{K}_2\text{CO}_3 + \text{KCN} + \text{CO} + \text{CO}_2$ , and the reaction of causing carbonation. With a further increase in cyanates and carbonates (aging) the reaction proceeds according to equation  $4\text{KCNO} \rightarrow \text{K}_2\text{CO}_3 + 2\text{KCN} + \text{CO} + \text{CO}_2$ , in which  $\text{CO}$  reacts with  $\text{Fe}$ , but, since the reaction being slow, the carbide layer is limited to the surface and interferes with  $\text{N}$  penetration. In the final stage cyanates and carbonates reach the saturation point and the reaction proceeds as  $5\text{KCNO} \rightarrow \text{K}_2\text{CO}_3 + 3\text{KCN} + \text{CO} + \text{CO}_2$ , leading to nitration alone. These observations were checked by means of a bath containing 90%  $\text{K}_2\text{Fe}(\text{CN})_6$  and 10%  $\text{NaOH}$ . The presence of the brittle carbide layer depends on the degree of bath aging.



NEM NALOV S. A.

**Diffusion of small additions of cadmium and bismuth in zinc**  
 in pure zinc and in brasses. *Trudy Inst. Fiz. Metallov*, No. 11, 80-108 (1961).  
 Authors: N. N. Gerasimov and V. A. Zolotarev. *Met. Sci. Eng.* 1962, No. 11, 80-108 (1962).  
 Cadmium and bismuth, wires of brass made with 99.97% Cu and pure Zn and its alloys with 0.17-0.19% Be or Sb were tested in the original state and after proving their grain by 5% stretching and heating. Wires 1.1 mm. in diam. and 20 mm. long were weighed, placed in a porcelain boat, and inserted in a quartz tube, evacuated to  $10^{-4}$  mm. of Hg, and sealed. Then specimens were heated 10-140 min. at 700-800°, cooled, and weighed. The test was repeated on the same specimens to det. diffusion as a function of time. The derived equation was  $Q/t/d^2 = 2 \pi^2 D/C_0$ , where  $Q$  is mass of Zn diffused,  $C_0$  is initial concn. of Zn,  $D$  diffusion coeff., and  $t$  time. In all alloys the diffusion coeff. of Zn increased with decreasing grain size, but to a different extent for different alloys. In Be brass the diffusion of Zn along intercryst. surfaces is hindered more than in pure brass. Since diffusion velocity of Zn in both these metals approaches the same value, it is probable that small percentages of Be added to the brass first act on grain density adjoining intercryst. planes and change their diffusion characteristics. This isoprobic effect is quite marked. J. D. Coburn.

*D. J. A.*

TRAPEZNIKOV, V.A.; NEMMONOV, S.A.

Vacuum X-ray spectrograph with bent crystal. Fiz.met.i metalloved.  
1 no.3:562-563 '55. (MLRA 9:6)

1.Institut fiziki metallov Ural'skogo filiala AN SSSR.  
(Spectrograph)



NEMNOV, S. A. and TRAPEZNIKOV, V. A.

"The problem pertaining to the local heterogeneity of concentrating dissolved element in solid solutions", appearing in the "Works of the Institute on the Physics of Metals, Issue 16, Collection of Research Papers on Diffusion and Internal Adsorption in Metals and Alloys", (Trudy Instituta Fiziki Metallov, vypusk 16, Sbornik Rabot Po Issledvaniyu Diffuzii I Vnutrennei Adsorbtsii V Metallakh I Splavakh), published by Ural Branch of the Academy of Science USSR, p 123, 1955.

*NEMNOV, S. A.*

Distr: 4E2c

*18 18*  
 \*An Investigation of the Binding Energy of Iron-Molybdenum Solid Solutions by Means of the Fine Structure of the X-Ray Absorption Spectra. V. A. Trapeznikov and S. A. Nemnov (*Fizika Metallov i Metallovedenie*, 1956, 3, (2), 214-220) [in Russian]. Micro-photometric traces of the K-absorption edge of metals show a fine structure consisting of numerous minor absorption peaks. T. and N. analyse the position and intensity of these peaks and their temp. variation in Ni, Co, and Fe-Mo alloys contg. 0, 0.5, 1, 2, and 4% Mo. The results lead to rejection of a theory of the fine structure due to Kronig (*Z. Physik*, 1931, 70, 317), which relates it to long-range order. Instead, a theory due to Kostarev (*Zhur. Exper. Teoret. Fiziki*, 1941, 21, 60) is to be preferred. This relates the fine structure to nearest-neighbour effects. Using this and later theories of Kostarev, T. and N. deduce the variation of binding energy with temp. and compn. for Fe-Mo alloys. 12 ref.

-A. F. B.

*Inet. Physical Metallurgy, Ural Affil, A.S. USSR*

MEMORANDUM 4

NEMZONOV, S. A., and TRAPEZNIKOV, V. A.

"Investigation of Binding Forces in Solid Iron-Molybdenum Solutions According to the Fine Structures of X-ray Absorption Spectra"

Materials of the 2nd All-Union Conference on X-ray Spectroscopy; Moscow, January 31 to February 4, 1957 (Materialy II Vsesoyuznogo soveshchaniya po rentgenovskoy spektroskopii; Moskva, 31 yanvarya - fevralya 1957 g.)

Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1957, Vol 21, Nr 10, pp 1341 - 1342 (USSR)

UFAN

MEMORANDUM  
NEMNOV, S. A. and KOLABOVA, K. M.

"Interrelationship of Some X-ray Spectral and Magnetic Characteristics of Iron-Base Alloys"

Materials of the 2nd All-Union Conference on X-ray Spectroscopy; Moscow, January 31 to February 4, 1957 (Materialy II Vsesoyuznogo soveshchaniya po rentgenovskoy spektroskopii; Moskva, 31 yanvarya - fevralya 1957 g.)

Izvestiya Akademii Nauk SSSR, Seriya fizicheskaya, 1957, Vol 21, Nr 10, pp 1341 - 1342 (USSR)

NEMONOV, S.A.; TRAPEZNIKOV, V.A.; KOLOBOVA, K.M.

X-ray spectroscopic investigation of iron-molybdenum and iron-aluminum  
alloys. Issl. po sharopr. splav. 3:279-291 ' 58. (MIRA 11:11)  
(Iron-molybdenum alloys--Metallography)  
(Iron-aluminum alloys--Metallography) (X ray spectroscopy)

SOV/137-59-5-10603

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 5, p 162 (USSR)

AUTHOR: Nemmonov, S.A.

TITLE: Application of X-Ray Spectroscopy to Investigate the Energy Spectrum of Electrons and Interatomic Forces in Solids

PERIODICAL: Tr. In-ta fiz. metallov. Ural'skiy fil. AS USSR, 1958, Nr 20, pp 169 - 186

ABSTRACT: This is a review on the application of X-ray spectroscopy to investigate the combination of energetic peculiarities in the electronic structure of various types of solids, including the character and strength of interatomic forces. There are 39 bibliographical titles.

L G

Card 1/1

AUTHORS: Nemnonov, S. A. and Kolobova, K. M. SOV/126-6-1-30/33  
 TITLE: On the Character of Interatomic Bonds in Iron-Aluminium  
 Alloys (K voprosu o kharaktere mezhatomnykh sil svyazi  
 v zhelezoaluminiumyevykh splavakh)  
 PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 1, No 1,  
 pp 183-185 (USSR)

ABSTRACT: In an earlier work (Ref. 1) the authors analysed data indicating  
 a lowering of the value of the asymmetry index of certain  
 spectrum lines of iron as a function of the concentration  
 and the valency of the non-transient element (aluminium  
 and zinc) entering in an iron-base alloy and the conclusion  
 was arrived at that a part of the electrons of the most  
 external atoms of aluminium or zinc entering into the  
 electron group of the crystal can penetrate into the 3d-  
 band of the iron atoms and reduce there the number of  
 non-compensated spin electrons which bring about the  
 asymmetry index  $K_{\alpha_1}$  of the spectrum line and the

of the average atomic magnetic moment of the alloy.  
 Therefrom the assumption was expressed that in iron-  
 aluminium alloys, in addition to a metallic bond, an

Card 1/2

SOV/128-6-1-30/33

On the Character of Interatomic Bonds in Iron-Aluminium Alloys

ionic component of the interatomic interaction exists the importance of which should increase with increasing aluminium concentration. In this paper the authors investigated the fine structure of the K-absorption spectra of iron in iron-aluminium alloys of the same composition (9.9, 17, 25, 50 and 75 at.% aluminium) at the same heat treatment as in the above mentioned paper. The absorption spectra of the iron were obtained at the temperature of the absorbing element; the linear dispersion amounted to 2.5 XE/mm. Sharply pronounced absorption maxima were observed in some alloys which is characteristic indication of the presence of ionic bonds. There are 2 figures, 1 table and 12 references: 5 of which are Soviet, 4 English, 3 German.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR  
(Institute of Metal Physics, Ural Branch, Acad. Sci. USSR)  
SUBMITTED: August 5, 1957

Card 2/2 1. Aluminum-iron alloys--Atomic structure 2. Aluminum-iron alloys--Bonding 3. Aluminum-iron alloys--Spectra



AUTHORS: Memenov, S.A. and Zakharov, K.L. SOV/122-6-1-11/72  
 TITLE: The Relations between the Magnetic and X-ray  
 Characteristics of Iron-base Alloys (O vzaimosvyazi  
 nekotorykh rentgenospektrolyakh i magnitnykh  
 kharakteristik splavov na osnove zheleza)  
 PERIODICAL: Fizika Metallov i Metallovedeniye, 1972, Vol 1, No 1,  
 pp 466-474 (USSR)

ABSTRACT: The discussion relates to the line shapes of the  $K_{\alpha 1}$   
 lines, which show maximal asymmetry at Fe (caused  
 by 3d-2p interaction), but no splitting (the same applies  
 to  $K_{\alpha 2}$ ). The line asymmetry and magnetic moment of the  
 divalent ion run parallel in the elements around Fe (Fig.1).  
 Only Fe-Al and Fe-Zn alloys are used (10, 15, 25, 50 and  
 75 at.% Al; 25, 50 and 75 at.% Zn), with armco iron.  
 The Al-Fe alloys were homogenized at 350-900°C for  
 25-30 hours (after preparation by vacuum fusion); the  
 Zn-Fe were prepared by diffusing the Zn under vacuum  
 into Fe foil at 670-680°C over thirty hours, followed  
 by holding at 700-750°C for 12-15 hours. The lines were  
 excited either by direct electron bombardment, or in  
 Card 1/3 fluorescence, and examined on a bent-crystal spectrograph.

SOV/126-6-3-11/32  
The Relations between Certain Magnetic and X-ray Characteristics  
of Iron-base Alloys

of dispersion about 3 kX/mm. Tables 1 and 2 give the experimental and calculated line asymmetries, which agree well. Fig. 2 shows these results, plus some on alloys with Mo (abscissa at.% alloying element). The results are considered to indicate a partial rearrangement of the 3d shell in the Fe, but the nature of the interatomic bonds is neglected. The effects to be expected in the two-phase regions of composition are considered, and shown to be found (within the rather large experimental errors) in the results presented for Zn-Fe, though the effects are rather complicated. Figs. 3 and 4 compare the variations of Bohr magneton number with content of alloying element for Ni and Fe respectively (the Ni results are from references (10 and (11)); Snyder's explanation (Ref. 3) is in general confirmed.

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SOV/126-6-3-11/32  
The Relations between Certain Magnetic and X-ray Characteristics  
of Iron-base Alloys

There are 4 figures, 2 tables and 12 references, 6 of  
which are Soviet, 6 English.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR  
(Institute of Metal Physics, Ural Branch of the  
Ac.Sc., USSR)

SUBMITTED: January 24, 1957

1. Iron alloys--X-ray analysis    2. Electron bombardment--Appli-  
cations    3. Iron alloys--Magnetic properties

Card 3/3

SOV/126-6-5-39/43

AUTHORS: Nemnonov, S.A. and Klyushin, V.V.

TITLE: Investigation of the  $L_{III}$  Absorption Spectra of Cerium in Cerium-aluminium Alloys (Issledovaniye  $L_{III}$  spektrov pogloshcheniya tseriya v tseriyalyuminiyevykh splavakh)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, pp 951 - 952 (USSR)

ABSTRACT: X-ray absorption spectra of cerium (10  $\mu$  foil) and of  $CeAl_2$  and  $CeAl_4$  (powders) were obtained by means of a Johann-type spectrometer with linear dispersion of 2.48 X-units/mm. The  $L_{III}$  absorption-edge structure in cerium and  $CeAl_2$  is shown in Figure 1 (absorption coefficient plotted against X-ray energy in the range 5 700 - 5 750 eV). Similar results were obtained for  $CeAl_4$ . In a short discussion of the spectra of Figure 1 the authors show that interatomic bonds in the intermetallic compounds  $CeAl_2$  and  $CeAl_4$  are much stronger than those in Ce or Al, primarily because of

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Investigation of the  $L_{III}$  Absorption Spectra of Cerium in  
Cerium-aluminium Alloys

SOW/126-6-5-39/43

6s and 5d cerium electron interactions. This explains why the melting points of  $CeAl_2$  (1465 °C) and  $CeAl_4$  (1250 °C) are higher than those of Ce (830 °C) and Al (660 °C). A more detailed discussion of the interatomic forces in Ce-Al alloys and compounds will be published later. There are 1 figure and 3 German references.

ASSOCIATIONS: Institut fiziki metallor Ural'skogo filiala AN  
SSSR (Institute of Physics of Metals, Ural Branch  
of AS SSSR)

SUBMITTED: January 29, 1958  
Card 2/2

SOV/120-7-0-10/24  
AUTHORS: Nemnonov, S.A. and Finkel'shteyn, L.D.  
TITLE: ~~On the Change of~~ the Debye Temperature During Ordering  
of the Alloy  $\text{Fe}_3\text{Al}$   
PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, No 3,  
pp 944-945 (USSR)

ABSTRACT: Iveronova et al. (Ref 5) have found that the Debye temperature in the alloy  $\text{Ni}_3\text{Fe}$  is lower in the ordered state than in the disordered. In the present work the Debye temperature of the alloy  $\text{Fe}_3\text{Al}$  in the ordered and disordered states was measured. The measurement was carried out by an X-ray method described by Il'ina (Ref 4), immediately after pouring liquid nitrogen over the specimen. The relative intensities of the lines (220), (321), (411) and (510) were determined. The ordered state of the  $\text{Fe}_3\text{Al}$  alloy was obtained by annealing  $\text{Fe}_3\text{Al}$  powder at  $370^\circ\text{C}$  for 23 hours. The disordered state was attained by cold deformation: filing and grinding the powder in a mortar. No signs of super structure lines are evident in X-ray pictures of specimens of the deformed alloy. As a result of the investigation, it was found that Card 1/2 the Debye temperature of the  $\text{Fe}_3\text{Al}$  alloy is lower in the

On the Change of the Debye Temperature During Ordering of the  
Alloy  $\text{Fe}_3\text{Al}$  SOV/126-7-6-24/24

ordered than in the disordered state (see table, p 944, and Fig 1). Other properties of the interatomic forces also point to a lower bond strength in the ordered than in the disordered state. According to Il'ina (Ref 4), the Debye temperature of pure metals is the same in the annealed as in the deformed state. From this it can be concluded that deformation alone does not bring about a redistribution of the alloy element, but leads to a change in Debye temperature. Hence the increase of the Debye temperature of the  $\text{Fe}_3\text{Al}$  alloy in the deformed state, compared with the annealed one, can be ascribed to the action of disordering. There are 1 table, 1 figure and 5 references, 4 of which are Soviet and 1 English.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc., USSR)

SUBMITTED: May 12, 1958

Card 2/2

SOV/126 8 . 25/-3

AUTHORS: Nemnonov, S.A., Oleynik, M.I. and Frolov, A.P.  
TITLE: Contribution on a Method for X-ray Investigation of  
Substances at High Pressure 1 A Sectional X Ray Tube  
PERIODICAL: Fizika metallov i metallovedeniye 1959, Vol 8, Nr 1,  
pp 158-160 (USSR)

ABSTRACT: To reduce the long exposure times normally required for  
X-ray investigations at high pressures the Institut  
fiziki metallov AN SSSR (Institute of Physics of Metals,  
Ac Sc., USSR) have developed and made an electronic  
X-ray tube which can be taken apart. The tube (Fig 1)  
is of simple construction and provides a very powerful  
X-ray beam. The cathode is connected to a URS-70 X-ray  
apparatus inter-locked with a TsVL-100 diffusion pump.  
Suitable provision is made for avoiding ingress of oil  
vapour  
there are 3 figures and 1 Soviet reference

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics  
of Metals Ac Sc., USSR)

SUBMITTED December 4 1958  
Card 1/1



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SOV/126-8-3-33/33

AUTHORS: Nemnonov, S.A. and Kolobova, K.M.

TITLE: X-Ray K-Spectrum of Iron Absorption at the Temperature of Liquid Nitrogen

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 478-480 (USSR)

ABSTRACT: The authors have carried out an investigation of the K-spectrum of pure iron absorption at two temperatures, +20 and -180°C. The specially constructed container for liquid nitrogen had a common vacuum with a spectrograph. The temperature of the absorbent was determined by means of a copper-constantan thermocouple welded to the absorption apparatus and corresponded to -180°C. The spectra were photographed in a first-order reflection of the crystallographic quartz plane (1340). The dispersion in the region under consideration was 2.5 XE/mm. In Fig 1, K-region curves of iron absorption obtained at +20 and -180°C are shown. Microphotograms of these regions, registered in an MF-4 instrument, are shown in Fig 2. All spectra were obtained from one and the same absorbent. The table (p 480) shows the ratios between fluctuation amplitudes. The authors assume that

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SOV/126-B-3-33/33

X-Ray K-Spectrum of Iron Absorption at the Temperature of Liquid Nitrogen

as the result of a decrease of lattice parameter, the degree of overlapping of the 3d-, 4s- and 4p-zones of metallic iron increases; this means that the distribution of density states with regard to energies and the probability of the respective transitions can change. There are 2 figures, 1 table and 4 references, 2 of which are German, 1 Soviet and 1 French.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics AS USSR)

SUBMITTED: April 1, 1959

Card 2/2

24(7)

AUTHORS: Nemnonov, S. A., Men'shikov, A. Z.

SOV/48-23-5-9/31

TITLE: The K-Absorption Spectra of Chromium in Borides, Carbides, Nitrides and Some Other Compounds (K-spektry pogloshcheniya khroma v boridakh, karbidakh, nitridakh i nekotorykh drugikh soyedineniyakh)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 5, pp 578 - 581 (USSR)

ABSTRACT: Many papers published recently deal with the investigation of the character of interaction between the transition group metal atoms and the metalloid atoms of the first series (B,C,N,O). The present paper deals with the investigation of chromium compounds. Ten compounds are then mentioned, that were investigated by the authors; among them, the borides and carbides were prepared in the Institut metallokeramiki i spetssplyavov AN USSR (Institute of Powder Metallurgy and Special Alloys of the AS USSR). The chromium oxides were obtained by oxidation of electrolytic chromium at 1000°C. Details concerning the experimental conditions are then given. The determination of magnetizability was made by P. G. Rudomanov

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The K-Absorption Spectra of Chromium in Borides,  
Carbides, Nitrides and Some Other Compounds

SOV/48-23-5-9/31

in the Laboratoriya magnitnogo strukturnogo analiza Instituta fiziki metallov AN SSSR (Laboratory of Magnetic Structural Analysis of the Institute of the Physics of Metals, AS USSR). Some similar works carried out by non-Russian scientists are described, and their results concerning the electron changes of state are mentioned. The results of the authors' own measurements of the K-absorption of chromium in the compounds and of metallic chromium are shown in a diagram (Fig 1). These results are then discussed, and the electron changes of state are concluded from them; the electron configuration of chromium both in compounds and in the pure state is given in a table. There are 1 figure, 1 table, and 13 references, 7 of which are Soviet.

Card 2/2

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AUTHORS: Nemirov, S.A. Men'shikov, A.Z.

TITLE: K-spectra of chromium absorption in borides, carbides, nitrides and some other compounds

PERIODICAL: Referativnyi zhurnal, Metallurgiya, no. 5, 1964, 30, abstract 17, 281  
"Tr. Seminara po zharostoykim materialam" [In: metallokarantiny i  
apats, arlov AN UkrSSR, no. 5, Kiev, 1960, 21 - 27]

TEXT: A x-ray spectroscopic investigation was made of the nature of interaction between the metal atoms of the transition group Cr with metalloides B, C, N, and O, interstitial phase  $CrB$ ,  $CrB_2$ ,  $Cr_3C_2$ ,  $Cr_4C_3$ ,  $Cr_2N$ ,  $Cr_3N$ ,  $Cr_2O_3$  and chromically pure  $Cr_2O_3$  and  $Cr_2SO_4$  salts were investigated. The x-ray K-edge of Cr absorption was studied. For all the phases investigated magnetic susceptibility was measured. The following conclusions are drawn: 1) the metal-like compounds and the nature of bond for  $Cr$  is complex; 2) the nature of interaction between Cr atoms and B, C, N, O is different; 3) from an electronic point of view Cr is a polyvalent metal; 4) it is not possible to relate different

Card 1/2

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ACCF/AIG

K-spectra ...

compounds within the phase diagram of the type  $AB_2$ . Since an essential part  
is played by the metalloid concentration, it is particularly characteristic  
of  $CrN$ ,  $Cr_2N$ ,  $CrB$  and  $Cr_2B$ . 4) The synthesis of the metalloid state of the  
metalloid atom can be generalized to the whole class of the Haag interstitial  
phases.

J. Bruckner

[Abstracter's note: Complete translation]

Card 2/2

S/126/60/009/02/014/033

AUTHORS: Nemnonov, S.A., Finkel'shteyn, L.D. and Kolobova, K.M. 21

TITLE: X-ray Diffraction and X-ray Spectroscopic Investigation of Interatomic Bonding Forces in Iron-aluminium Alloys

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 2, pp 243 - 247 (USSR)

ABSTRACT: Two of the authors (Refs 3,4) have studied iron-aluminium alloys (9-75 at.% Al) by X-ray spectroscopic methods. They concluded that in the interaction of iron and aluminium atoms iron is electronegative with respect to aluminium. Further information on atomic interaction has been obtained by neutron-diffraction measurements of atomic magnetic moments (Ref 5). According to other works (Ref 6) in alloys with less than 25 at.% Al a closest order of the  $Fe_3Al$  type exists. The concentration redistribution of aluminium would appear to be the physical nature of the K-state in the given alloys. The Debye temperature and associated values are sensitive to the presence of the K-state and the authors therefore studied

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S/126/60/009/02/014/033

E111/E335

X-ray Diffraction and X-ray Spectroscopic Investigation of  
Interatomic Bonding Forces in Iron-aluminium Alloys

their variations in iron-aluminium alloys (2, 4, 10, 17, 25 and 50 at.% Al), previously homogenized at 800 °C and annealed at temperatures under 550 °C (heat treatment details and results are tabulated). Published (Ref 8) methods were used. A parallel study was also made of the ratio of the amplitudes of fluctuation of the coefficient of absorption of the fine structure of the K-region of iron absorption (Figure 1 shows the general form of K-region iron-absorption). Figure 2 shows the ratio and the Debye temperature as functions of aluminium content (0-25 at.% Al), while in Figure 3 K-region characteristics are similarly plotted (0-50 at.% Al). In work by two of the authors (Nemnonov and Kolobova) being published the sensitivity was noted of one of these characteristics, the energy interval between points corresponding to  $3/4$  and  $1/4$  of the height of the initial absorption range, to temperature (thermal oscillation). The reduction in its value towards 17 at.% Al in Figure 3 therefore confirms the indications of Figure 2 of

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S/126/60/009/02/014/033

E111/E335

X-ray Diffraction and X-ray Spectroscopic Investigation of  
Interatomic Bonding Forces in Iron-aluminium Alloys

increasing strength of interatomic bonds in iron-aluminium  
alloys.

There are 3 figures, 1 table and 12 references. 9 of  
which are Soviet, 2 English and 1 German.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of  
Physics of Metals of the Ac.Sc., USSR)

SUBMITTED: June 12, 1959



Card 3/3

69690  
S/126/60/009/03/013/033  
E193/E483

5.2610  
AUTHORS:

Nemnonov, S.A. and Men'shikov, A.Z.

TITLE:

X-Ray E Absorption Spectra of Chromium in Silicides  
PP 385-389 (USSR)

ABSTRACT:

The problem of the precise nature of the atomic bonding in silicides of certain transition metals is still a subject of controversy. According to Robins (Ref 1) and Nikitin (Ref 2) these substances are essentially intermetallic compounds and should be considered in the frame of the electron band theory. This view is supported by the following facts: (1) electrical conductivity of silicides is relatively high and often exceeds that of their constituents; (2) the temperature coefficient of electrical resistivity is positive and of the order of magnitude similar to that of the transition metals; (3) silicides are paramagnetic, their magnetic susceptibility varying only slightly with temperature. On the other hand, Pouling and Soldate (Ref 3), who had calculated the length of the bond and the number of bonding electrons in iron silicide (FeSi), reached the

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S/126/60/009/03/013/033

E193/E483

**X-Ray K Absorption Spectra of Chromium in Silicides**

conclusion that compounds of this type fit very well the concepts of the resonance covalent bonding. The object of the investigation, described in the present paper, was to study the nature of the bond in silicides of transition metals by X-ray analysis. The experimental materials comprised chromium and several chromium silicides. Some of the properties of these compounds are given in Table 1 under the following headings: formula; type of the crystal lattice (cubic, tetragonal, cubic, hexagonal); symmetry group; lattice parameter, Å; electrical conductivity  $\text{ohm}^{-1} \text{cm}^{-1}$ ; magnetic susceptibility,  $\times 10^6$ , CGCM. The experimental technique used has been described elsewhere (Ref 9). The results, in the form of K absorption edges of pure chromium and chromium in various silicides, are reproduced graphically on p 386, where  $\mu/\rho$  (a quantity proportional to the absorption coefficient) is plotted against the energy (eV), measured from an arbitrary zero value. In addition to obtaining the X-ray absorption spectra, the present authors, using data due to Pouling (Ref 10), calculated

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S/126/60/009/03/013/033  
E193/E483X-Ray  $\kappa$  Absorption Spectra of Chromium in Silicides

the lengths of the bonds and the number of bonding electrons in the investigated compounds. The results are given in Table 2 under the following headings: formula of the compound;  $N$ ,  $R_n$ ,  $n$ , and  $n_{ob}$ , for the Cr-Cr bond;  $N$ ,  $R_n$ ,  $n$ , and  $n_{ob}$ , for the Cr-Si bond;  $\Sigma n_{ob}$ . Here  $N$  denotes the number of neighbouring atoms of one element,  $R_n = R_1 - 0.3 \log n$ , where  $R_n$  - length of the bond in which  $n$  electrons of a given atom participate,  $R_1$  - unit bond length (taken to be equal to the covalent atomic radii of Cr and Si, ie 1.172 and 1.173 Å, respectively),  $\Sigma n_{ob}$  denoting the total number of electrons of the chromium atom participating in the bond (ie the valency displayed by chromium). Analysis of these results, correlated with those obtained by other workers, led the present authors to a tentative conclusion that chromium silicides are characterized by a duplex metallic-covalent bond. The higher the silicon content, the less metallic in nature becomes the bond and in  $CrSi_2$  the covalent bond becomes predominant. There are 1 figure, 2 tables and 11 references, 5 of

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S/126/60/009/03/013/033  
E193/E483

X-Ray K Absorption Spectra of Chromium in Silicides  
which are Soviet, 4 English and 2 German.  
ASSOCIATION: Institut fiziki metallov AN SSSR  
(Institute of Physics of Metals, AS USSR)

SUBMITTED: June 9, 1959

Card 4/4

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5:2200 (B)

00215  
S/126/60/009/04/010/033  
E111/E435

AUTHORS: Nemnonov, S.A. and Finkel'shteyn, L.D. ✓

TITLE: Nature of the Interaction of Atoms in the Hydrides of Certain Transition Metals

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 4, pp 530-534 (USSR)

ABSTRACT: The authors point out that the nature of the interaction between atoms in transition-metal hydrides and the state of the hydrogen in them are still debatable. They examine the different published views on this (Ref 1 to 6) and tabulate calculated nearest distances between titanium atoms in metallic titanium, titanium nitride, carbide and the hydrides, TiH<sub>0.95</sub> and TiH<sub>1.97</sub>. Their experimental work described in the present article consisted in the X-ray study of vanadium carbide. ✓ They studied the K-end of vanadium absorption in pure vanadium and vanadium hydride with 45 atomic % hydrogen (figure). The latter was supplied by I.I. Matveyenko of the Institut khimii UFAN SSSR (Chemistry Institute of UFAN SSSR). The analyser was a quartz crystal with a

Card 1/3 (1340) reflecting surface ( $d_1 = 1173.98 \times E$ ) and ✓

80215

S/126/60/009/04/010/033

E111/E435

Nature of the Interaction of Atoms in the Hydrides of Certain  
Transition Metals

440 nm radius of curvature. The authors discuss the weakening (for the vanadium hydride) and the reported (Ref 7) disappearance for titanium and zirconium hydrides of the long-wave absorption lines in the K-spectra of the corresponding metals. In the  $\beta$ -hydrides the bond between the metal and hydrogen is ionic-covalent and unlocalized. In the  $\alpha$ -hydrides magnetic resonance suggests a different bonding, perhaps of the metallic type (Ref 8). The difference in the nature of the atomic interaction in saturated hydrides of transition metals of the start and end of the long periods is attributable primarily to the fact that the electromagnetic nature of transition elements generally increases towards the end of a period, approaching that for hydrogen; again, the stability and heat of formation of hydrides starting with the chromium group falls sharply (Ref 5). There are 1 figure, 1 table and 8 references, 4 of which are Soviet, 3 English and 1 German.

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E111/E435

Nature of the Interaction of Atoms in the Hydrides of Certain  
Transition Metals

ASSOCIATION: Institut fiziki metallov AN SSSR  
(Institute of Physics of Metals AS USSR)

SUBMITTED: July 6, 1959

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S/126/60/010/001/027/027/XX  
E032/E314

AUTHORS: ~~Nemnov, S.A.~~, Sorokina, M.F. and  
Finkel'shteyn, L.D.

TITLE: Study of the K Absorption Edge in a Zinc-Aluminium  
Alloy with Small Zinc Concentration

PERIODICAL: Fizika metallov i metallovedeniye, 1960,  
Vol. 10, No. 1, pp. 148 - 150

TEXT: The present authors have investigated the K edge of zinc and aluminium in the alloy Al + 1.7% Zn (0.7 at.%) which constituted a solid solution based on the face-centred aluminium lattice. The K edge of Zn was obtained in the first-order reflection from quartz. The figure shows the K absorption edge of Al in the above alloy (Curve 1), the K absorption edge of Zn in this alloy (Curve 2) and the K absorption edge of pure Zn (Curve 3). It was found that the K absorption edges of Al and Zn in this alloy are displaced towards lower energies relative to the K absorption edge for pure Zn. The fine structures of the K edge of Zn and Al, including the position of the first maximum are very similar.

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S/126/60/010/001/027/027/XX  
E032/E314

Study of the K Absorption Edge in a Zinc-Aluminium Alloy with Small Zinc Concentration

The K edge of Zn in the alloy is displaced by about 0.8 eV from the position of the K edge in pure Zn. The fine structure obtained is summarised in the following table

	Extrema, eV				
	A	$\alpha$	B	$\beta$	C
K edge of Al in the alloy Al + 1.7% Zn	6.0	9.0	13.7	27.6	38.2
K edge of Zn in the alloy Al + 1.7% Zn	6.2	8.8	13.9	28.0	40.2
K edge of Zn (metal)	10.1	16.2	18.8	24.0	38.4

where A, B, C are the positions of the first three maxima, respectively, and  $\alpha$  and  $\beta$  are the positions of the

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S/126/60/010/001/027/027/XX  
E032/E314

Study of the K Absorption Edge in a Zinc-Aluminium Alloy with  
Small Zinc Concentration

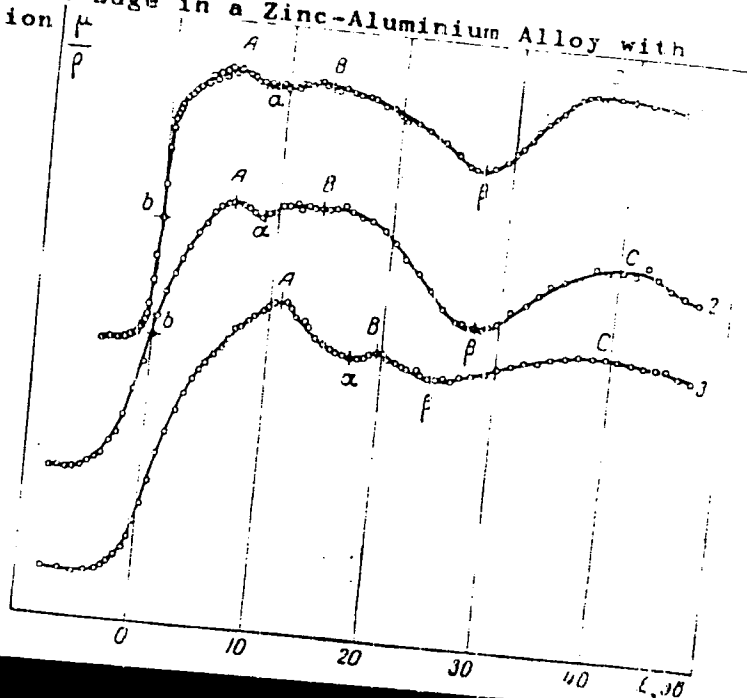
first three maxima, respectively, and  $\alpha$  and  $\beta$  are the positions of the first two minima, respectively. The slope of the rapidly varying part of the absorption curve is roughly the same in the case of pure Zn and the Zn in the alloy but is very different (higher) for the Al. There are 1 figure, 1 table and 2 references: 1 Soviet and 1 non-Soviet.

ASSOCIATION: Institut fiziki metallov AN SSSR  
(Institute of Metal Physics of the AS USSR)

SUBMITTED: December 4, 1959

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S/126/60/010/001/027/027/XX  
EO32/E314  
Study of the K Absorption Edge in a Zinc-Aluminium Alloy with  
Small Zinc Concentration



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MEN'SHIKOV, A.Z.; NEMKONOV, S.A.

X-ray absorption spectra in compounds with a nickel-arsenide structure.  
Fiz. met. i metalloved. 10 no.3:390-396 S '60. (MIRA 13:10)

1. Institut fiziki metallov AN SSSR.  
(Nickel arsenides--Spectra) (Spectrum, X-ray)

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26334  
S/O48/51/125 4 08/05.1.69  
B104/3202

AUTHORS

Kamnorov, A. A., Finkel'shteyn, L. D.

TITLE

$K_{\alpha}$  emission bands and K absorption edge of aluminum in some alloys with transition metals

ABSTRACT

Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 8, 1961, 1007-1012

NOTE: The present paper was the subject of a lecture delivered at the 11th Conference on X-ray Spectroscopy at Kharkov, January 3 to January 4, 1961. The  $K_{\alpha}$  emission spectra and the absorption spectra of aluminum were taken by means of a quartz crystal (reflection from the surface) and a linear dispersion in the part of the spectrum/related was 40  $\text{mm}^{-1}$ . The  $K_{\alpha}$  emission bands were excited by an X-ray source described in previous paper by A. A. Kamnorov and L. D. Finkel'shteyn, *Izv. Akad. Nauk SSSR, Seriya fizicheskaya*, 1961, no. 1, 100-101. The vacuum was kept in a range of  $10^{-5}$  to  $10^{-6}$  mm Hg.

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3, 348/618025 108 108 109  
2104/8

✓

emission bands and  $K_{\alpha}$  absorption ...  
The absorption edge was recorded at 5.33 eV and the  $K_{\alpha}$  absorption bands and the absorption edge of pure aluminum are discussed. The authors discuss the distribution of electronic states in the conduction band and state that the valence electrons of aluminum are distributed over two Brillouin zones, the first of which is completely, the second only partly filled. The first zone shows a reduction of the state density on transition from the first into the second zone. This is in agreement with the distance of the two absorption maxima of 7 and 11 eV from the edge of the long-wave band. In the second part the authors present measurement results of the  $K_{\alpha}$  emission bands of aluminum in alloys with transition metals. Fig. 1 shows some emission bands of alloys and compounds of Al with transition metals (Cr, Fe, and Ni). These diagrams show that the change of the emission bands on transition from higher intermetallic compounds to lower ones is identical in all three systems. The intensity of the short-wave part of the  $K_{\alpha}$  band is reduced if the content of the transition metal increases. For alloys with maximum content of transition metals  $Cr_{10}Al$ ,  
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$K_{\beta_x}$  emission bands and K absorption ...

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S/048/61/025/008/008,000  
B104/P202

$Fe_3Al$ ,  $Ni_3Al$ ) the bands become very narrow, almost symmetrical and, as compared to the  $K_{\beta_x}$  band of pure aluminum, are shifted to the side of lower energies. The table gives some data on the  $K_{\beta_x}$  bands of Al in the alloys studied. Fig. 4 shows three  $K_{\beta_x}$  bands of Al and Al-compounds. It is assumed that in compounds of Al with transition metals with a metallic bond, an interaction occurs between the atoms of the transition metals and of aluminum whose nature is similar to that of the covalent ionic bond between pure Al and oxygen in  $Al_2O_3$ . Furthermore, it is found that the polar covalent interaction between the atoms of the transition metals and Al is considerably smaller than in the ionic compound  $Al_2O_3$ . The change of the emission bands of Al alloys with transition metals in the direction to the  $K_{\beta_1}$  emission band of  $Al_2O_3$  proves the presence of a polar-covalent interaction in the compounds investigated. A similar development is assumed to take place in the K absorption edge of Al in some compounds with transition metals. Fig. 5 shows the K absorption edges of five compounds, the K absorption edge of pure Al being given for comparison.

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$\lambda_{\text{ex}}$  emission bands and  $K$  absorption ...

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S/C48/61/C25/008/018/019  
B104/B202

Only in  $\text{Ni}_2\text{Al}_3$  a shift towards shorter wavelengths is observed. The authors further study the absorption spectrum of aluminum and of compounds with transition metals with consideration of higher concentrations. There are 5 figures, 1 table, and 8 references: 3 Soviet-bloc and 5 non-Soviet-bloc.

ASSOCIATION. Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals of the Academy of Sciences U.S.S.R.)

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S/849/62/000/000/004/016  
A006/A101

AUTHORS: Nemnonov, S. A., Men'shikov, A. Z.

TITLE: Comparison of X-ray absorption K-spectra in compounds formed by chromium with elements of subgroup IV (C, Si, Ge)

SOURCE: Vysokotemperaturnyye metallokeramicheskiye materialy. Inst. metalloker. i spets. spl. AN Ukr.SSR. Kiev, Izd-vo AN Ukr.SSR, 1962, 29 - 35

TEXT: An investigation was made for the purpose of determining whether a correlation existed between X-ray spectra of metal-like compounds in the Cr-C, Cr-Si and Cr-Ge systems. The authors analyzed X-ray absorption K-spectra of chromium in carbides ( $\text{Cr}_4\text{C}$ ,  $\text{Cr}_7\text{C}_3$  and  $\text{Cr}_3\text{C}_2$ ), silicides ( $\text{Cr}_3\text{Si}$ ,  $\text{Cr}_3\text{Si}_2$  ( $\text{Cr}_5\text{Si}_3$ ),  $\text{CrSi}$  and  $\text{CrSi}_2$ ) and chromium alloys with germanium (50 and 60 at.% Ge). An illustration shows K-edges of chromium absorption in the compounds investigated. The energy state of the basic section of the main absorption edge is characterized by three points: point b - the center of the initial absorption range (section abc);  $\xi$  the center of the whole discontinuity; A - the first absorption

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Comparison of X-ray absorption K-spectra in...

S/849/62/000/000/004/016  
A006/A101

maximum. All the spectra investigated show an initial absorption range whose energy state is characterized by point b, which remains the same for all the compounds investigated, independent of the height of the initial absorption. Point c indicates satisfactorily the changes in the absorption intensity in the CFA range, which is displaced to the short wavelength side with higher ionization degree. These characteristic points make it possible to study in detail changes in the basic K-edge of Cr absorption from one compound to the other. The absorption coefficient curves obtained are analyzed and the absorption spectra of silicides and carbides are compared. It was found that the energy spectra of electronic vacancies of silicides and carbides are substantially different. Apparently the different atomic radii of carbon and silicon play an important part in the formation of the crystal lattice type and the nature of interatomic interaction. A comparison of Cr-Ge and Cr-Si spectra shows that a full analogy does not exist, although there are some common features. The different structures of the basic K-edge of Cr absorption near maximum A for CrGe and CrSi prove the substantial difference of their energy spectra in the indicated range. As a result the experiments performed have shown that there is a general resemblance in the structure of electron shells of elements of the

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Comparison of X-ray absorption K-spectra in...

S/849/62/000/000/004/016  
A006/A101

subgroup IV; nevertheless, carbon, silicon and germanium form metal-like compounds with chromium, whose structures of energy spectra and, consequently, whose physical properties are substantially different. The authors thank O. V. Samsonov, Corresponding Member of AS Ukr.SSR, for Cr-silicide and -carbide specimens made available. There are 1 figure and 1 table.

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MEN'SKIKOV, A.Z.; NEMNOV, S.A.

Effect of chemical bonding on the  $K_{\alpha 1}$  X-ray emission line in chromium compounds. Fiz. met. i metalloved. 14 no.2:186-194 Ag '62.  
(MIRA 15:12)

1. Institut fiziki metallov AN SSSR.  
(Chromium compounds) (X-ray spectroscopy)

MEN'SHIKOV, A.Z.; NEMNOV, S.A.; MISHCHENKO, L.B.

Effect of chemical bonds on  $L_2$  and  $L_3$  energy levels of a chromium  
atom. Fiz. met. i metalloved. 14 no.3:383-386 S '62.  
(MIRA 15:9)

1. Institut fiziki metallov AN SSSR.  
(Chromium--Spectra) (Chemical bonds)

S/126/62/014/004/008/017  
E111/E160

AUTHORS: Nemnonov, S.A., Sorokina, M.F., Men'shikov, A.Z.,  
Kolobova, K.M., and Finkel'shteyn, L.D.

TITLE: The character of the atomic interactions in the  
intermetallic compounds of the transition elements  
aluminium and silicon

PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.4, 1962,  
535-541

TEXT: A combination of the crystallochemical and X-ray  
spectroscopic characteristics of the compounds examined with their  
physicochemical properties, enables one to assert that the  
character of the interatomic bonding forces in these compounds  
( $\text{Fe}_3\text{Al}$ ,  $\text{NiAl}_3$ ,  $\text{FeSi}$ ,  $\text{CrSi}$ ,  $\text{CrAl}_7$ ,  $\text{MnAl}_6$ ,  $\text{FeAl}_3$ ,  $\text{Co}_2\text{Al}_9$ ,  $\text{CuAl}_2$ , etc)  
is extremely complicated. The structural characteristics, the  
X-ray emission data and the magnetic properties show the presence,  
on a background of the predominantly metallic interaction, of  
certain localised bonds between different kinds of atoms, in which  
the 3d electrons of the transition metal actively participate.

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The character of the atomic ...

S/126/62/014/004/008/017  
E111/E160

In all phases studied, the K absorption spectra of the transition metal show strong hybridisation of the 3d and 4s wave functions of the transition element with the 3p functions of aluminium or silicon. Allowing for certain conventions in the separation of the interatomic forces into their components, it can be reckoned that the predominantly metallic interaction is supplemented in the cases examined by the interaction of the covalent and resonating covalent type of bonding with a certain polarity, understood as a drawing out of the connecting electron cloud to the side of the more electronegative component (the transition metal). In the system transition metal / Al, this polar component of the bonding forces is strongly expressed but in the system transition metal / Si, it is almost absent.

There is 1 table.

ASSOCIATION: Institut fiziki metallov AN SSSR  
(Institute of Physics of Metals, AS USSR)

SUBMITTED: April 4, 1962.

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FINKEL'SHTEYN, L.D.; MEMONOV, S.A.

Correlation between changes in the K<sub>5</sub>-line intensity and the  
values of initial absorption regions in certain cobalt compounds.  
Fiz.met.1 metalloved. 14 no.5:660-665 M '62. (MIRA 15:12)

1. Institut fiziki metallov AN SSSR.  
(Cobalt compounds) (Absorption spectra)

S/126/62/014/005/003/015  
E111/E435

AUTHORS: Nemnonov, S.A., Sorokina, M.F., Kolobova, K.M.,  
Men'shikov, A.Z.

TITLE: Investigation of the structure of absorption K-spectra  
of transition metals in intermetallic compounds with  
aluminium and silicon

PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.5, 1962,  
666-672

TEXT: The K-edge of absorption has been studied of Cr-Al, Mn-Al, Fe-Al, Ni-Al, Cr-Si, Mn-Si, Fe-Si and Ni-Si alloys for ranges of concentration which included almost all the intermetallic compounds in these systems. For all the compounds investigated the "initial" (i.e. long wave-length) absorption remained fairly large and of the same order as in the pure metal. With increasing concentration of the transition component the break between the initial and the next intermediate region was smoothed. The energy position of the point corresponding to the Fermi boundary, mostly remained unchanged in most cases. The maximum which is characteristic of the pure transition metal was smoothed at a certain concentration of the second component, a new maximum

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Investigation of the structure ...

S/126/62/C14/005/003/015  
E111/E435

appearing 6 to 14 eV further towards the short wave-lengths side and becoming more pointed. The changes described became apparent while still within the solid-solution boundaries. Conclusion: in compounds with a high content of the non-transition component there is strong hybridization of the 3d-, 4s-wave functions of the transition metal with the 3p-wave functions of aluminium and silicon. There are 5 figures and 1 table. ✓

ASSOCIATION: Institut fiziki metallov AN SSSR  
(Institute of Physics of Metals AS USSR)

SUBMITTED: April 4, 1962

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NEMNOV, S.A.; KOLOBOVA, K.M.

Character of interatomic interactions and the state of internal  
iron atom electrons in silicides. Fiz.met.1 metalloved. 14  
no.6:874-879 D '62. (MIRA 16:2)

1. Institut fiziki metallov AN SSSR. (X-ray spectroscopy)  
(Iron silicide) (Electrons)

NEMNOV, S.A.; KOLOBOVA, K.M.

Absorption spectra of manganese and iron in alloys and compounds  
of Al, Si, P, S, and Cl. Izv.AN SSR.Ser.fiz. 27 no.3:390-393  
Mr. '63. (MIRA 16:2)

1. Institut fiziki metallov AN SSSR.  
(Manganese-iron alloys) (X-ray absorption)

2/048/63/027/003/017/025  
2106/2236

**AUTHORS:** Mos'chikov, A. S., and Nommenev, S. A.

**TITLE:** The effect of chemical bonding on the valency states of chromium atoms in various compounds

**PERIODICAL:** AKADEMIYA NAUK SSSR. IZVESTIYA. Seriya fizicheskaya, v.27, no. 3, 1963, 394-402

**TEXT:** The hardest line in the K spectrum of chromium, the  $K_{\beta_5}$  line, was studied in the following substances: Cr, CrB, CrB<sub>2</sub>, Cr<sub>4</sub>C, Cr<sub>7</sub>C<sub>3</sub>, Cr<sub>3</sub>C<sub>2</sub>, Cr<sub>2</sub>Al, CrAl<sub>4</sub>, Cr<sub>3</sub>Si, Cr<sub>2</sub>Si<sub>3</sub>, CrSi, CrSi<sub>2</sub>, Cr<sub>2</sub>N, CrN, Cr<sub>2</sub>O<sub>3</sub>, CrCl<sub>3</sub>, Cr<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>, CrS, CrSe, CrTe, CrSb and CrP. It may be assumed that the intensity distribution of the chromium  $K_{\beta_5}$  line is mainly determined in the various compounds by the density of the 3d levels in the hybridized dnp band. The line for the borides, nitrides, carbides and the oxides of chromium has two distinct humps. This can be explained in terms of the

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S/048/65/027/003/017/025  
B106/2258

The effect of chemical bonding on the ...  
degeneracy of the  $d$  orbital. The short-wave branch of the  $K_{\beta}$  band in chromium is due to the conducting electrons of the  $d_{xy}$  orbital. These are most numerous in chromium and decrease in number as the compounds become more ionic in character. This tendency can easily be observed in the sequence metal, carbide, nitride, oxide, chloride (sulfate), and also in the various silicides of chromium. The shape of the band in the metallic compounds  $CrTe$  and  $CrF$  and the semiconductors  $CrS$  and  $CrSe$  bear out the interpretation given. The long-wave maximum of the  $K_{\beta}$  band in the compounds investigated probably corresponds to the density of quasiatomic levels occupied by 3d electrons available for covalent bonding. These results lend weight to the recently developed concept of two sorts of  $d$  electrons in transition metals (Goodenough, J. B., Phys. Rev., 120, no. 1, 67, (1960)). In all the compounds, the  $K_{\beta}$  band is accompanied by a  $K_{\beta'}$  satellite, whose nature is dealt with in another paper (Men'shikov A. Z., Fizika metallov i metallovedeniye, 14, no. 3, Card 2/4



The effect of chemical bonding on the ... S/040/63/027/003/017/025  
R106/R238

596 (1962)). A  $K_{\beta}$  satellite also occurs, which is only absent from the spectrum of metallic chromium. Its spectral position depends considerably on the nature of the second component, but not on the concentration of the latter in the compound. For all the elements combining with chromium which were investigated, there is a connection between the electronegativity, the first ionization potential, and the energy difference between the maximum of the  $K_{\beta}$  line and the  $K_{\beta}$  satellite in the chromium spectrum.

This can be explained if the  $K_{\beta}$  satellite appears as a result of cross transitions by metalloid valency electrons to the empty  $K$  level of the metal. The appearance of the  $K_{\beta}$  satellite clearly indicates that there is an additional valency band connected with the ionic character of the  $Me - X$  interaction. The importance of this interpretation to electron energy spectra in solid state physics is mentioned. There are 4 figures and 1 table.

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The effect of chemical bonding on the ...

s/048/63/021/003/017/025  
B106/B238

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR  
(Institute of Physics of Metals of the Academy of Sciences  
USSR)

Card 4/4

ACCESSION NR: AP4028994

8/0126/64/017/003/0361/0369

AUTHOR: Gusatinskiy, A. N.; Nemmonov, S. A.

TITLE: On the fine structure nature of the x-ray  $L_{III}$  absorption region of indium in semiconductor compounds

SOURCE: Fizika metallov i metallovedeniye, vol. 17, no. 3, 1964, 361-369

TOPIC TAGS: x-ray spectrum, absorption spectrum, indium, semiconductor, semiconductor compounds, fine structure, photoelectron scattering, wave scattering

ABSTRACT: The fine structure of x-ray  $L_{III}$  absorption spectra of indium in semiconductor compounds of the type  $A_{II}B_{III}$ :InSb, InAs, InP, InN, as well as in  $In_2Te_3$  and  $In_2O_3$  is studied. It is shown that the theory which explains the fine structure by the probability changes of the transitions  $P(E)$  caused by the scattering of the photoelectron wave in surrounding atoms is as applicable to the objects studied in this work, as to metals and alloys for which the theory was developed. The predominant effect of the first coordination spheres on the type of thin structure of the x-ray absorption spectrum is shown by way of comparing the spectra of compounds having an identical neighbor, but a different distant order. The authors made an attempt to find the phase of electron wave scattering  $\eta_2(E)$  by way of comparing the

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ACCESSION NR: AP4028994

theoretical and experimental curves for the indium spectrum in the compound InSb. The study of the absorption probability as a function of the photon energy caused by the scattering of the photoelectron wave in the surrounding atoms  $\tau_p(E)$  represents a two-fold interest: 1) since the effect of this factor on the absorption coefficient is not doubted, then by just taking  $\tau_p(E)$  into consideration, it is possible to obtain the correct information relative to  $N(E)$ ; and 2) it should be anticipated that as a result of further development of the theory of this phenomenon, the possibility of producing a radial distribution of the absorbing atom potential from the experimentally found curve  $\eta(E)$  will arise. Orig. art. has: 3 formulas and 4 figures.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of the Physics of Metals, AN SSSR)

SUBMITTED: 06Jly63

DATE ACQ: 27Apr64

ENCL: 00

SUB CODE: PH, GE

NO REF SOV: 006

OTHER: 007

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